

Application No. 09/891,997
Amendment dated November 2, 2005
Reply to Office Action of May 2, 2005

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A liquid crystal display apparatus comprising:
a liquid crystal layer comprising liquid crystal and having a plurality of pixels arranged in a matrix composed of rows and ~~columns;~~columns, the liquid crystal having a memory effect, the liquid crystal exhibiting a cholesteric phase;
a number of first scanning electrodes aligned in a first direction at a first pitch, the number of the first scanning electrodes corresponding to a number of rows and each of the first scanning electrodes extending in a second direction substantially orthogonal to the first direction;
a plurality of signal electrodes facing the first scanning electrodes with the liquid crystal layer sandwiched between the signal electrodes and the first scanning electrodes, the signal electrodes being aligned in the second direction at a second pitch wider than the first pitch and each of the signal electrodes extending in the first direction;
a scanning electrode driver connected to the first scanning electrodes;
a signal electrode driver connected to the signal electrodes; and
a controller for controlling the scanning electrode driver and the signal electrode driver such that the scanning electrode driver selects the first scanning electrodes in a specified order by outputting a selective signal to each of the first scanning electrodes and the signal electrode driver outputs signals to the plurality of signal electrodes in accordance with image data to display the pixels on the row of the matrix corresponding to the selected scanning electrode.

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2. (Previously Presented) A liquid crystal display apparatus according to claim 1, wherein:

pixels are formed at intersections of the first scanning electrodes and the signal electrodes; and

each of the pixels is a rectangle having shorter sides which are parallel to the first direction and having longer sides which are parallel to the second direction.

3. (Previously Presented) A liquid crystal display apparatus according to claim 2, wherein:

a width of each of the first scanning electrodes defines a length of the shorter sides of each of the pixels; and

a width of each of the signal electrodes defines a length of the longer sides of each of the pixels.

4. (Previously Presented) A liquid crystal display apparatus according to claim 1, wherein the first pitch is $1/n$ of the second pitch, wherein n is a natural number not less than 2.

5. (Previously Presented) A liquid crystal display apparatus according to claim 4, wherein n is 2.

6. (Withdrawn) A liquid crystal display apparatus according to claim 1, wherein the first pitch is $1/n$ of the second pitch, wherein n is a number more than 1 and less than 2.

7. (Withdrawn) A liquid crystal display apparatus according to claim 6, further comprising:

a scanning electrode driver which is connected to the first scanning electrodes so as to apply voltages thereto;

a signal electrode driver which is connected to the signal electrodes so as to apply voltages thereto; and

a controller which is connected to the scanning electrode driver and the signal electrode driver so as to control the scanning electrode driver and the signal electrode driver.

8. (Withdrawn) A liquid crystal display according to claim 7, wherein the controller produces display data from original image data by carrying out an interpolation of the original image data with respect to the second direction and controls the scanning electrode driver and the signal electrode driver in accordance with the display data.

9. (Withdrawn) A liquid crystal display according to claim 8, wherein a number of lines in the second direction of the display data is n times a number of lines in the second direction of the original image data.

10. (Withdrawn) A liquid crystal display apparatus according to claim 9, wherein n is 1.5.

11. (Withdrawn) A liquid crystal display apparatus according to claim 10, wherein the controller produces display data for pixels on one scanning line from original image data for pixels on two successive scanning lines.

12. (Withdrawn) A liquid crystal display apparatus according to claim 11, wherein the controller produces display data for pixels on one scanning line by averaging image data for pixels on two successive scanning lines.

13. (Withdrawn) A liquid crystal display apparatus according to claim 11, wherein the controller produces display data for pixels on one scanning line by comparing original image data for pixels on two successive scanning lines.

14. (Withdrawn) A liquid crystal display apparatus according to claim 7, further comprising:

a memory for storing font data which are exclusively used in the liquid crystal display apparatus,

wherein the controller uses the font data in a case where the original image data contains text data.

15. (Withdrawn) A liquid crystal display apparatus according to claim 1, further comprising:

a plurality of second scanning electrodes aligned in the first direction at a third pitch wider than the first pitch, each of the second scanning electrodes extending in the second direction.

16. (Withdrawn) A liquid crystal display apparatus according to claim 15, further comprising:

a scanning electrode driver which is connected to the first scanning electrodes and the second scanning electrodes so as to apply voltages thereto;

a signal electrode driver which is connected to the signal electrodes so as to apply voltages thereto; and

a controller which is connected to the scanning electrode driver and the signal electrode driver so as to control the scanning electrode driver and the signal electrode driver.

17. (Withdrawn) A liquid crystal display apparatus according to claim 16, wherein the controller controls the scanning electrode driver and the signal electrode driver to scan the second scanning electrodes by interlace scanning.

18. (Withdrawn) A liquid crystal display apparatus according to claim 16, wherein the controller controls the scanning electrode driver and the signal electrode driver to scan the first scanning electrodes in order of the alignment thereof.

19. (Withdrawn) A liquid crystal display apparatus according to claim 16, wherein the scanning electrode driver comprises:

at least one first driver IC which is connected to some of the first scanning electrodes and which is located at a first end of the first scanning electrodes with respect to the second direction;

at least one second driver IC which is connected to others of the first scanning electrodes and which is located at a second end, which is opposite to the first end, of the first scanning electrodes; and

at least one third driver IC which is connected to the second scanning electrodes and which is located at the first end.

20. (Withdrawn) A liquid crystal display according to claim 15, wherein the signal electrodes are shared to be coupled with the first scanning electrodes and the second scanning electrodes.

21. (Withdrawn) A liquid crystal display apparatus according to claim 15, wherein the signal electrodes comprise:

a plurality of first signal electrodes which are coupled with the first scanning electrodes; and

a plurality of second signal electrodes which are coupled with the second scanning electrodes.

22. (Withdrawn) A liquid crystal display apparatus according to claim 21, further comprising:

at least one first driver IC which is connected to the first signal electrodes and which is located at a first end of the first and second signal electrodes with respect to the first direction; and

at least one second driver IC which is connected to the second signal electrodes and which is located at a second end, which is opposite to the first end, of the first and second signal electrodes.

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23. (Withdrawn) A liquid crystal display apparatus according to claim 15, wherein the first pitch is $1/n$ of the second pitch, wherein n is a natural number not less than 2.

24. (Withdrawn) A liquid crystal display apparatus according to claim 23, further comprising:

a scanning electrode driver which is connected to the first scanning electrodes and the second scanning electrodes so as to apply voltages thereto;

a signal electrode driver which is connected to the first signal electrodes so as to apply voltages thereto; and

a controller which is connected to the scanning electrode driver and to the signal electrode driver so as to control the scanning electrode driver and the signal electrode driver.

25. (Withdrawn) A liquid crystal display apparatus according to claim 24, wherein the controller controls the scanning electrode driver and the signal electrode driver to reset the liquid crystal of the liquid crystal layer and then to write an image by interlace scanning.

26. (Withdrawn) A liquid crystal display apparatus according to claim 25, wherein:

in carrying out the interlace scanning, a frame is divided into n fields, wherein n is a natural number not less than 2; and

the first pitch is $1/n$ of the second pitch.

27. Canceled.

28. Canceled.

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29. (Currently Amended) A liquid crystal display apparatus according to claim [[28,]]1, wherein the liquid crystal comprises a nematic liquid crystal compound and a chiral agent.

30. (Withdrawn) A liquid crystal display apparatus comprising:
a liquid crystal layer comprising liquid crystal;
a plurality of scanning electrodes aligned in a first direction at a first pitch, each of the scanning electrodes extending in a second direction substantially orthogonal to the first direction; and
a plurality of signal electrodes facing the scanning electrodes with the liquid crystal layer sandwiched between the signal electrodes and the scanning electrodes, the signal electrodes being aligned in the second direction at a second pitch and each of the signal electrodes extending in the first direction,
wherein one of the first pitch and the second pitch is $1/n$ of the other, wherein $1 < n < 2$.

31. (Withdrawn) A liquid crystal display apparatus according to claim 30, wherein n is 1.5

32. (Withdrawn) A liquid crystal display apparatus according to claim 30, wherein the first pitch is $1/n$ of the second pitch.

33. (Withdrawn) A liquid crystal display apparatus according to claim 32, wherein n is 1.5.

34. (Withdrawn) A liquid crystal display apparatus according to claim 30, wherein the liquid crystal has a memory effect.

35. (Withdrawn) A liquid crystal display apparatus according to claim 34, wherein the liquid crystal exhibits a cholesteric phase.

36. (Withdrawn) A liquid crystal display apparatus according to claim 35, wherein the liquid crystal comprises a nematic liquid crystal compound and a chiral agent.

37. (Withdrawn) A liquid crystal display apparatus comprising:
a liquid crystal layer comprising liquid crystal;
a plurality of first scanning electrodes aligned in a first direction at a first pitch, each of the first scanning electrodes extending in a second direction substantially orthogonal to the first direction;
a plurality of second scanning electrodes aligned in the first direction at a second pitch that is different from the first pitch, each of the second scanning electrodes extending in the second direction; and
a plurality of signal electrodes facing the first and second scanning electrodes with the liquid crystal layer sandwiched between the signal electrodes and the first and second scanning electrodes, the signal electrodes being aligned in the second direction at a third pitch and each of the signal electrodes extending in the first direction.

38. (Withdrawn) A liquid crystal display apparatus according to claim 37, wherein the signal electrodes comprise:

a plurality of first signal electrodes which are coupled with the first scanning electrodes; and
a plurality of second signal electrodes which are coupled with the second scanning electrodes.

39. (Withdrawn) A liquid crystal display apparatus according to claim 37, wherein the signal electrodes are shared to be coupled with the first scanning electrodes and the second scanning electrodes.

40. (Withdrawn) A liquid crystal display apparatus according to claim 37, wherein the first pitch is 1/n of the second pitch, wherein n is a natural number not less than 2.

41. (Withdrawn) A liquid crystal display apparatus according to claim 37, wherein the liquid crystal has a memory effect.

42. (Withdrawn) A liquid crystal display apparatus according to claim 41, wherein the liquid crystal exhibits a cholesteric phase.

43. (Withdrawn) A liquid crystal display apparatus according to claim 42, wherein the liquid crystal comprises a nematic liquid crystal compound and a chiral agent.

44. (Previously Presented) A liquid crystal display apparatus according to claim 1, wherein all of the pixels display a same color.

45. (Previously Presented) A liquid crystal display apparatus according to claim 1, the selective signal output from the scanning electrode driver is higher than the signals output from the signal electrode driver.

46. (Previously Presented) A liquid crystal display apparatus according to claim 1, wherein a pulse form of the signals output from the signal electrode driver is variable in accordance with the image data.

47. (Currently Amended) A liquid crystal display apparatus comprising:
a liquid crystal layer comprising liquid crystal and having a plurality of pixels arranged in a matrix composed of rows and columns, said liquid crystal having a memory effect, said liquid crystal exhibiting a cholesteric phase, said pixels aligned in a first direction along the columns at a first pitch and in a second direction along the rows at a second pitch wider than the first pitch;

a plurality of first scanning electrodes aligned in the first direction, a number of the first scanning electrodes corresponding to a number of rows and each of the first scanning electrodes extending in the second direction substantially orthogonal to the first direction;

a plurality of signal electrodes facing the first scanning electrodes, the signal electrodes being aligned in the second direction, a number of the signal electrodes

corresponding to a number of columns and each of the signal electrodes extending in the first direction;

a scanning electrode driver connected to the first scanning electrodes;

a signal electrode driver connected to the signal electrodes; and

a controller for controlling the scanning electrode driver and the signal electrode driver such that the scanning electrode driver selects the scanning electrodes in a specified order by outputting a selective signal to each of the scanning electrodes and the signal electrode driver outputs signals to the plurality of signal electrodes in accordance with image data to display the pixels on the row of the matrix corresponding to the selected scanning electrode.

48. (New) A liquid crystal display apparatus comprising:

a liquid crystal layer comprising liquid crystal and having a plurality of pixels arranged in a matrix composed of rows and columns, the liquid crystal having a memory effect, the liquid crystal exhibiting a cholesteric phase;

a plurality of first scanning electrodes aligned in a first direction at a first pitch, a quantity of the first scanning electrodes corresponding to a quantity of rows, and each of the first scanning electrodes extending in a second direction substantially orthogonal to the first direction;

a plurality of signal electrodes facing the first scanning electrodes with the liquid crystal layer sandwiched between the signal electrodes and the first scanning electrodes, the signal electrodes being aligned in the second direction at a second pitch wider than the first pitch and each of the signal electrodes extending in the first direction;

a scanning electrode driver connected to the first scanning electrodes;

a signal electrode driver connected to the signal electrodes; and

a controller for controlling the scanning electrode driver and the signal electrode driver such that the scanning electrode driver selects the first scanning electrodes in a specified order by outputting a selective signal to each of the first scanning electrodes and the signal electrode driver outputs signals to the plurality of signal electrodes in accordance with image data to display the pixels on the row of the matrix corresponding to

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the selected scanning electrode,

wherein while each of the first scanning electrodes is being selected, the pixels corresponding to the selected first scanning electrodes are not displayed.